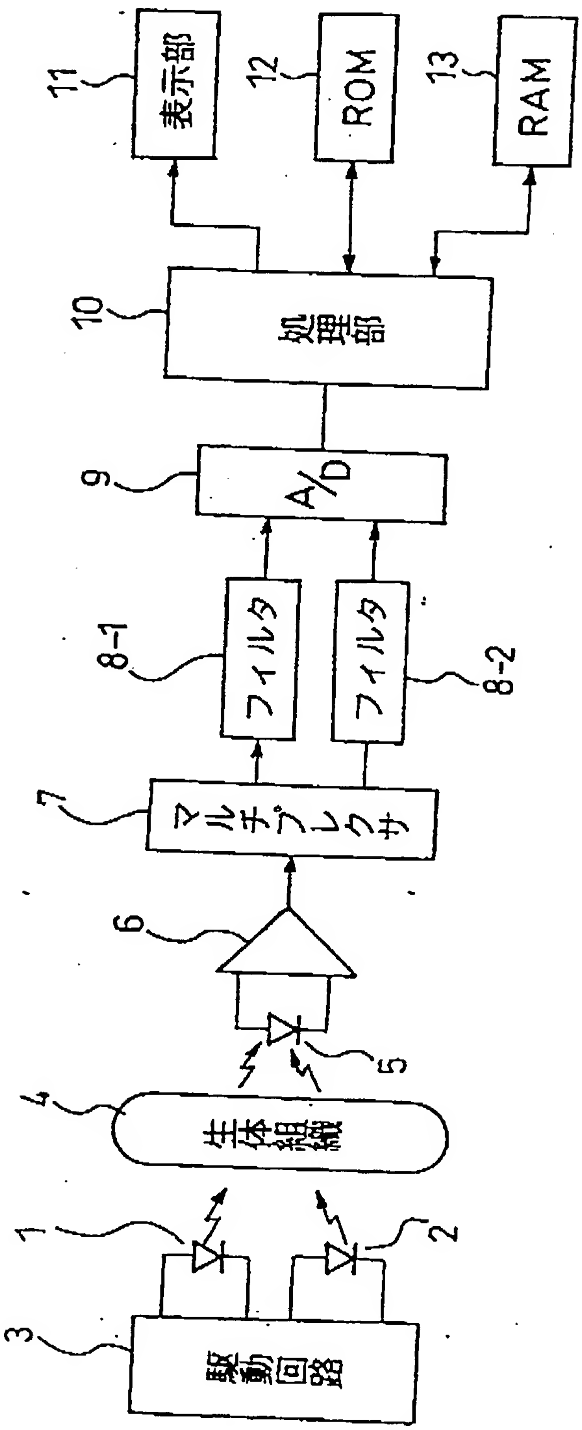
Fig. 1



3: light source driver
4: living tissue
7: multiplexer
8-1, 8-2: filter
9: A/D converter
10: processor
11: display

Fig. 2

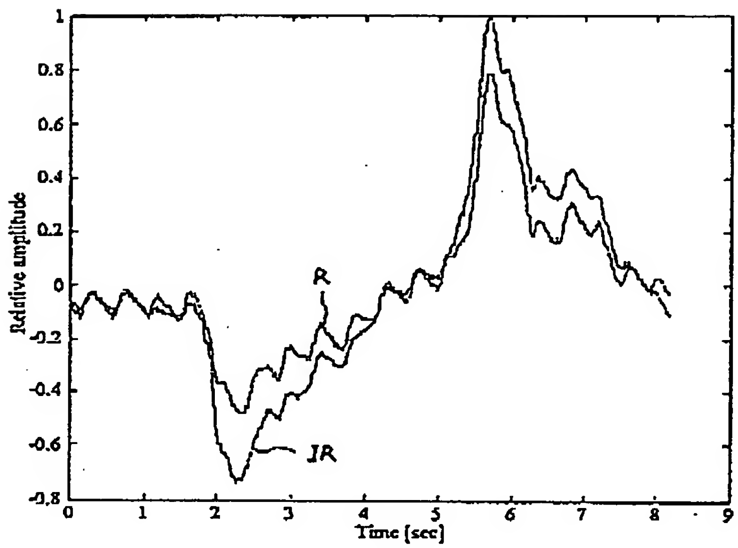

Relative amplitude
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0
1
2
3
4
5
6
7
8
9
Time [sec]
R
JR

Fig. 3

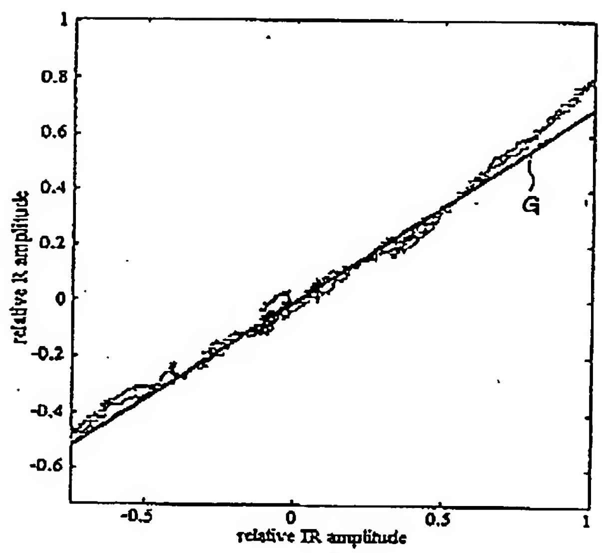

1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
relative R amplitude
G
-0.5
0
0.5
1
relative IR amplitude

Fig. 4

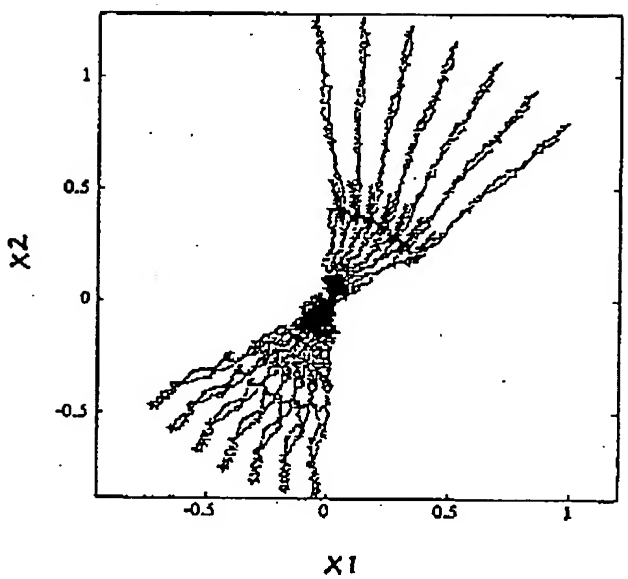
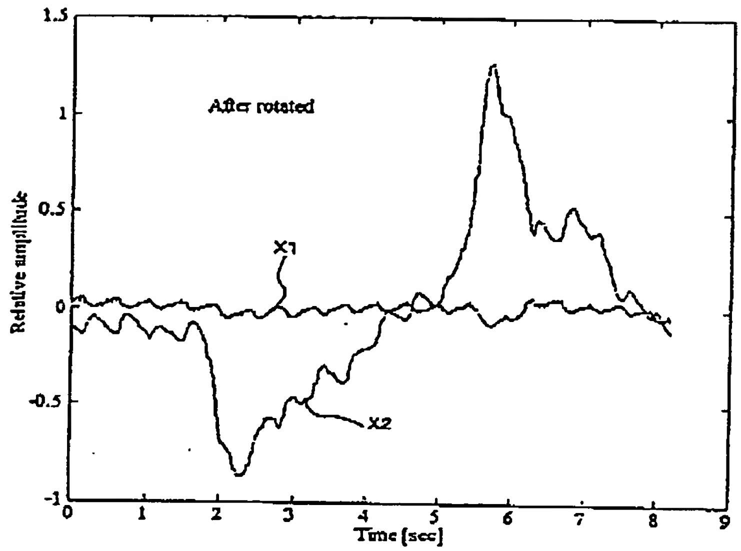


Fig. 5


After rotated
X1
X2
Relative amplitude
Time [sec]
1.5
1
0.5
0
-0.5
-1
0
1
2
3
4
5
6
7
8
9

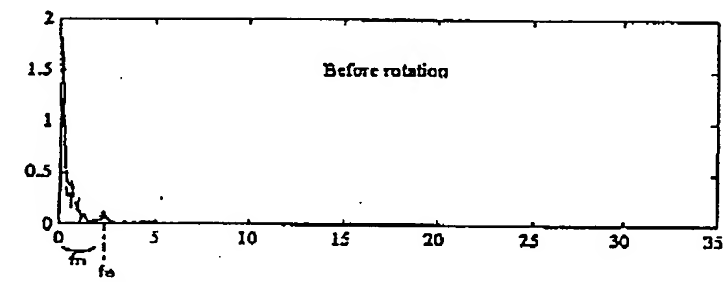

Before rotation
2
1.5
1
0.5
0
0
5
10
15
20
25
30
35
fn
fs

Fig. 6A

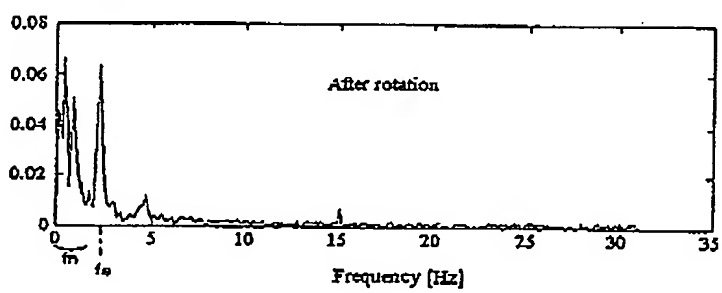
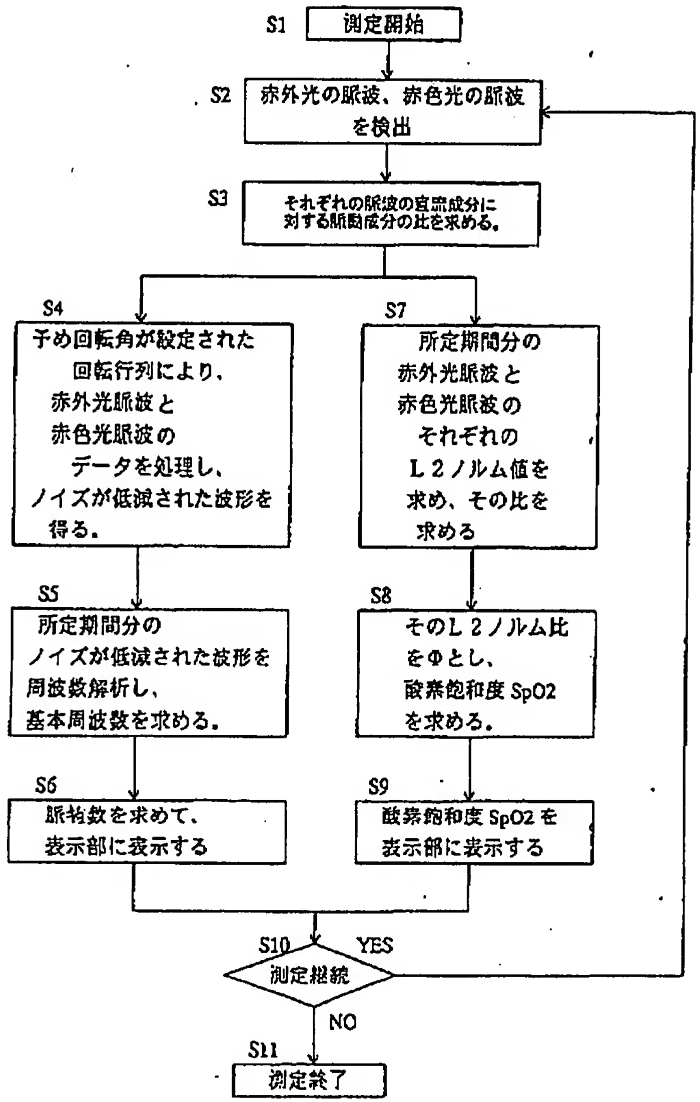

After rotation
0.08
0.06
0.04
0.02
0
0
5
10
15
20
25
30
35
fn
fs
Frequency [Hz]

Fig. 6B

Fig. 7



S1: start measurement

S2: detect pulse wave signals pertaining to infrared light and red light

S3: obtain ratio of pulsation component to DC component for each pulse wave signal

S4: obtain noise-reduced waveform by processing respective pulse wave data with rotating matrix (rotating angle is predetermined)

S5: obtain fundamental frequency by frequency analysis with respect to noise-reduced waveform for given time period

S6: obtain and display pulse rate

S7: obtain L2 norm values from respective pulse wave signals of given time period and obtain ratio thereof

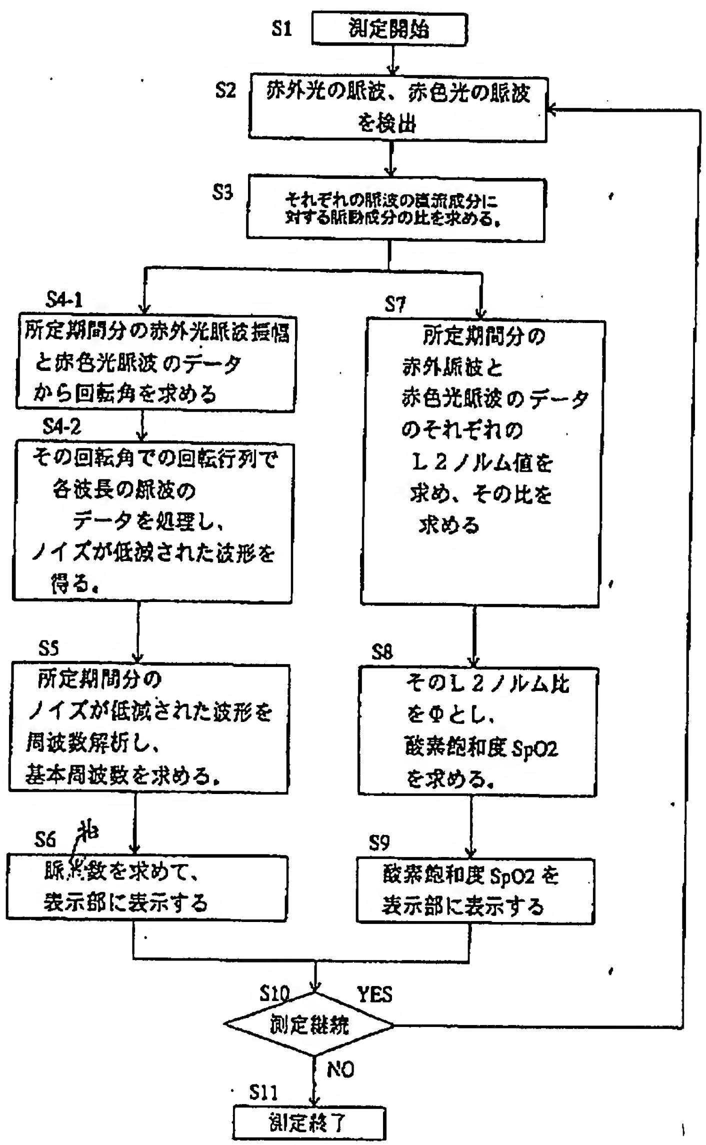
S8: obtain oxygen saturation from L2 norm ratio

S9: display oxygen saturation

S10: measurement is continued?

S11: terminate measurement

Fig. 8



S1: start measurement

S2: detect pulse wave signals pertaining to infrared light and red light

S3: obtain ratio of pulsation component to DC component for each pulse wave

S4-1: obtain rotating angle from respective pulse wave data for given time period

S4-2: obtain noise-reduced waveform by processing respective pulse wave data with rotating matrix corresponding to obtained rotating angle

S5: obtain fundamental frequency by frequency analysis with respect to noise-reduced waveform for given time period

S6: obtain and display pulse rate

S7: obtain L2 norm values from respective pulse wave signals of given time period and obtain ratio thereof

S8: obtain oxygen saturation from L2 norm ratio

S9: display oxygen saturation

S10: measurement is continued?

S11: terminate measurement

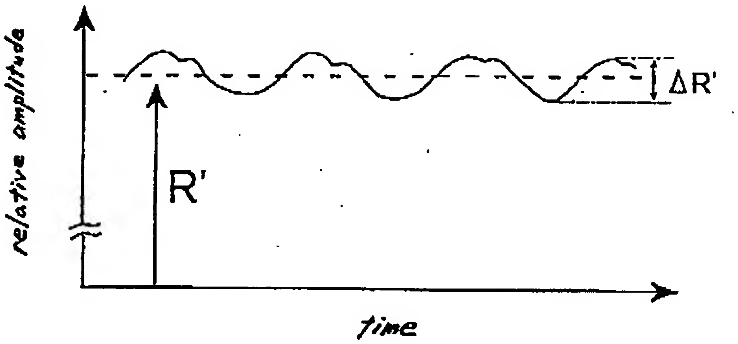

ΔR'
R'
relative amplitude
time

Fig. 9A

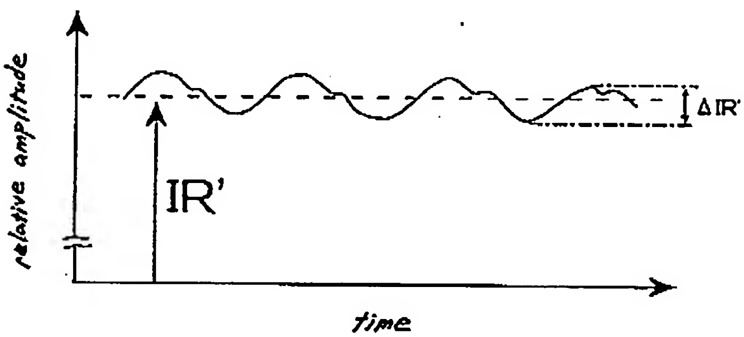
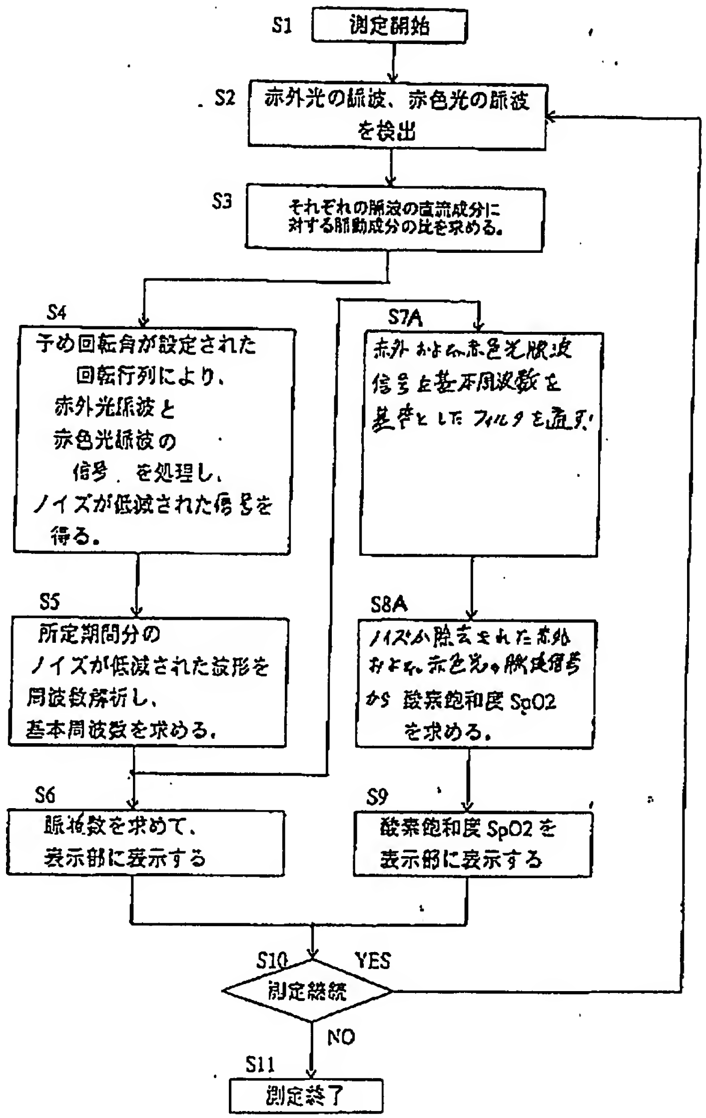

ΔIR'
IR'
relative amplitude
time

Fig. 9B

Fig. 10



S1: start measurement

S2: detect pulse wave signals pertaining to infrared light and red light

S3: obtain ratio of pulsation component to DC component for each pulse wave

S4: obtain noise-reduced waveform by processing respective pulse wave data with rotating matrix (rotating angle is predetermined)

S5: obtain fundamental frequency by frequency analysis with respect to noise-reduced waveform for given time period

S6: obtain and display pulse rate

S7A: pass respective pulse wave signals through filter associated with fundamental frequency to obtain noise-reduced pulse wave signals

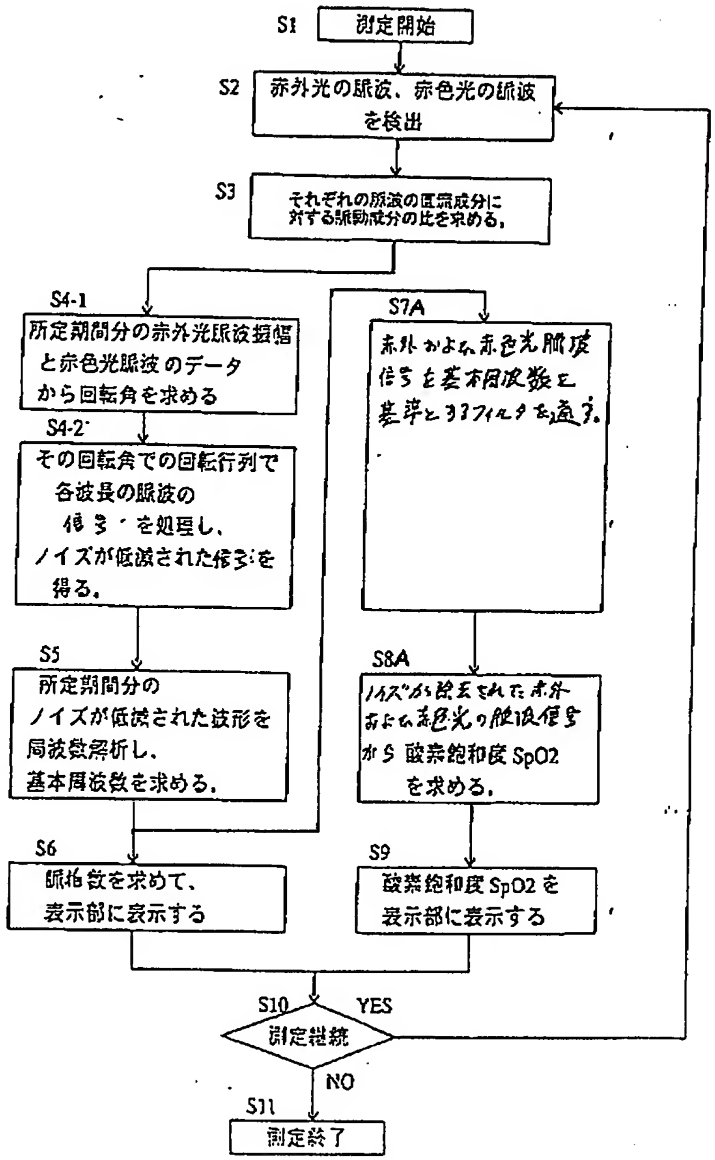
S8A: obtain oxygen saturation from ratio of noise-reduced pulse wave signals

S9: display oxygen saturation

S10: measurement is continued?

S11: terminate measurement

Fig. 11



S1: start measurement

S2: detect pulse wave signals pertaining to infrared light and red light

S3: obtain ratio of pulsation component to DC component for each pulse wave

S4-1: obtain rotating angle from respective pulse wave data for given time period

S4-2: obtain noise-reduced waveform by processing respective pulse wave data with rotating matrix corresponding to obtained rotating angle

S5: obtain fundamental frequency by frequency analysis with respect to noise-reduced waveform for given time period

S6: obtain and display pulse rate

S7A: pass respective pulse wave signals through filter associated with fundamental frequency to obtain noise-reduced pulse wave signals

S8A: obtain oxygen saturation from ratio of noise-reduced pulse wave signals

S9: display oxygen saturation

S10: measurement is continued?

S11: terminate measurement